

## EDITORIAL

### CONTINGENT REVIEWS

*And now my labor is over. I have had my lecture. I have no sense of fatherhood. If my genetic and personal histories had been different, I should have come into possession of a different lecture. If I deserve any credit at all, it is simply for having served as a place in which certain processes could take place.*

From "A Lecture on 'Having' a Poem"  
(Skinner, 1972, p. 355)

Once again it is appropriate to extend Skinner's generative metaphor to the having of reviews (Catania, 1976, 1984). I began attending to the having of reviews in the late 1960s, during my own editorial term. I continued through 1976 under the *JEAB* editorships of Stanley S. Pliskoff and Victor G. Laties, and then again from 1984 to date under the *JEAB* editorships of Philip N. Hineline and Edmund Fantino. Philip N. Hineline has been appointed as the next Review Editor. I thank the SEAB Board of Directors and the editors under whom I served for allowing me the opportunity to interact with so many of the authors who delivered to us their books and/or their reviews.

This time of editorial transition seems an appropriate one for an overview of the *JEAB* reviews, and Philip N. Hineline and I are therefore editing a collection of these reviews that will eventually appear as a SEAB publication. The pages needed for a full set of the *JEAB* reviews would number far too many to fit in one volume, so the process of editorial selection will inevitably lead to significant omissions; we hope the final product will at least represent within a single convenient volume both the quality and the breadth of the reviews that have appeared in *JEAB*.

In such endeavors loose ends are inevitable, and one function of this editorial is to tie off a few of them. As before, there were books never matched to appropriate reviewers and invited reviews that never got written. Matching book to reviewer is a chancy business with regard to both timing and context. What follows, then, is some commentary on some books that may be relevant to the interests of the *JEAB* audience. The organization of my commentary, such as it is, is best regarded as a consequence of relaxed editorial contingencies.

I would like here to record my debt to

Allen Neuringer for calling to my attention some of the features of the book I discuss first and at greatest length. It was once a candidate for a combination review that would also treat Gleick's *Chaos* (1987; cf. Catania, 1989a) and related works, but that review did not come to pass. Such are the contingencies that operate on editorial selection.

#### *Wonderful Life (Gould, 1989)*

Instead of beginning at the beginning, I start somewhat later, bypassing the Big Bang and the evolution of stars and planets and even the origins of life on earth and skipping forward about 4 billion years. Our planet is roughly 4.5 billion years old, and life has existed on it for most of that time. Chemical and fossil evidence indicates that life began within the first billion years or so, but over most of the next 3 billion years it consisted of single-celled organisms.

We pick up the thread at the end of that time period. Multicellular organisms appeared only about 570 million years ago, in the geological period called the Cambrian. An explosion in the diversity of multicellular life occurred during the Cambrian period and was followed by a weeding out; the survivors provided the major groupings from which contemporary species evolved. One of those was the vertebrates. Many other significant events followed, such as the colonization of land. The dinosaurs were a spectacular part of the story, but they came much later and by 65 million years ago they were gone. Their passing allowed the evolution of large mammals; we humans eventually emerged from that line. All of us are descendants of a very long line of survivors.

*Wonderful Life* is the story of the Cambrian explosion of multicellular life and how some of its characteristics and its implications were worked out by paleontologists. The narrative

revolves around the Burgess Shale, a paleontological site in the Canadian Rockies discovered by Charles D. Walcott in 1909. In it were samples of the multicellular Cambrian fauna, with soft as well as hard parts preserved. Other sites have since been found in other parts of the world, confirming that the variety of organisms found at the Burgess site was geographically widely dispersed.

Contemporary animal life consists of at most two or three dozen phyla; among the most familiar are sponges, arthropods, annelids, mollusks, echinoderms, and chordates (vertebrates and their relatives), to mention only a few. The significance of the Cambrian fauna is best summarized by quoting Gould: "the Burgess Shale, one small quarry in British Columbia, contains the remains of some fifteen or twenty organisms so different one from the other, and so unlike anything now living, that each ought to rank as a separate phylum" (Gould, 1989, p. 99).

One part of Gould's interpretation of these findings is that the branches of the evolutionary tree are not continually diversifying. Instead, it began with great diversification, and its branches have been repeatedly pruned. Some of the most drastic thinning occurred during the Cambrian Era. For Gould, contingency is central, but not in the sense of relations between events and their consequences; rather, he emphasizes contingency in the sense of historical accident. Perhaps events unrelated to local selective contingencies at some early time in the history of life on earth made the difference between the survival of our vertebrate ancestors or one of those other potential phyla from the Burgess Shale, much as some global cataclysm (such as the impact of a comet) may have eradicated the dinosaurs and made room for large mammals.

Gould's (1989) treatment of contingency is closely related to the concept of chaos, in Gleick's (1987) book cited above. Chaos, in the sense of Gleick's title, is a branch of mathematics that deals with nonlinear systems. Such systems involve recursive computations, in which the output of an equation serves as the input for its next iteration. Many natural phenomena, including the operation of behavioral contingencies, are best described in terms of such systems. One of their significant properties is that they are drastically affected even by very small changes in initial

value. For example, predictions of weather patterns based on nonlinear systems imply that the flap of a butterfly's wings today can affect the direction in which a storm system moves some weeks from now.

Consider the implications by imagining that the flap of the wings of a single butterfly a few weeks earlier altered the battle of Waterloo. The weather at the battle was slightly different, so small changes in the pace and posture of the participants changed the outcome. Perhaps Wellington was slain by a musketball, but in our retelling that alteration is only of modest significance. What is more important is that the smoke rose differently from the battlefield. Worldwide, little by little, the details of the weather began to deviate from what occurred in our own history. Darwin had already been born, but would he sail on the *Beagle* in that world?

For each of us there are still more drastic implications. Perhaps after just a few months, every act of human procreation would have occurred at a somewhat different time or in a somewhat different place. What are the odds, then, that any of the sperm that fertilized eggs in the history of our world would also have done so in that one? Long before the 20th century, things would have changed so much that no individual now alive would have been conceived in that alternate world. No doubt some individuals would have had the same names as their existing counterparts, but all would be different. Of those who determined the fate of so many in our world, no Hitler or Stalin or Gandhi or Mao. Of those crucial to our history of psychology, no Pavlov or Freud or Watson or Thorndike. No Skinner. Others in their places and in ours. But neither you nor me.

How close a call it was. Now think of all the butterflies. And if that does not give you pause, imagine these contingencies extending back 570 million years, to the start of the Cambrian Era. These are the vast improbabilities made apparent by Gould's treatment of contingency (Gould speaks of the imaginary experiment of replaying life's tape, but, curiously, he does not cite Gleick, though he has done so elsewhere).

Beyond the concept of contingency, how is this relevant to behavior? Like the weather, behavior is a nonlinear system. For measurement at any level of precision, the math-

ematics of chaos demonstrates that, although we can predict kinds of things that will happen, we cannot predict specific detail (e.g., we can predict that a pigeon will peck a key, but not precisely when). This enhances the import of interpretation relative to prediction and control, and in many applications interpretation is all that is feasible.

Gould (1989) raises questions about the contingencies that may have operated on the evolution of anatomies, but one crucial ingredient that is absent from the fossil record of the Burgess Shale, soft parts or no, is the behavior of those long-gone organisms. They included predator and prey, and they varied in motor and sensory systems. There must have been much accident in their selection. On the other hand, their selection depended not only on anatomy but also, and perhaps to a greater degree, on behavior. The modifiability of behavior may well have come much later, but can something of the selective contingencies of those times be derived from the comparative sensory and motor systems of the Cambrian fauna? Fossil behavior is limited to traces such as footprints or teeth marks on bone, but an account of the evolution of behavior is worthy of pursuit; before we give up on it, should we not consider the possibility of a behavioral paleontology?

#### *From Primate Origins to Language*

In the context of the Burgess Shale and the Paleozoic Era, it may seem odd to refer to our primate origins in terms of beginnings. Let us nevertheless jump ahead a half billion years or so. As in human genealogy, it is easiest to trace ancestries by working back from the present, and so much material is available that I will only comment briefly on a few recent books. Good starting places for a general review are Conroy's *Primate Evolution* (1990) and Richards' *Human Evolution* (1987). With regard to behavior, studies of contemporary primate behavior may cast light on the evolution of human sexuality, as in Hrdy's *The Woman That Never Evolved* (1981), or on the evolution of human social and antisocial behavior, as in de Waal's *Peacemaking Among Primates* (1989). Some researchers, such as Cheney and Seyfarth in *How Monkeys See the World* (1990), still want to get inside the monkey mind, but as they try to do so they cannot help telling us about

the monkey's environment and its behavior. With regard to the evolution of language, it is still the same old story: Attempts to reconstruct the evolution of human language reliably miss its function as an efficient way by which one individual changes the behavior of another, and instead appeal to cognitive structures, such as the representational systems proposed by Bickerton in *Language and Species* (1990).

It is easy to be diverted from the treatment of language as behavior, and it is therefore useful to be reminded of the many ways in which the behavior of one organism can provide stimuli that set the occasion for the behavior of others. *Animal Language* (Bright, 1984) covers many of the stimulus functions of animal sounds, from the chirps of crickets and the croaks of frogs to the calls of birds and the songs of whales. Primates are included, but only in the context of field studies (do not look here for a treatment of attempts to teach language to apes). Although its definition of communication is that "an animal has communicated with another when it has transmitted information that influences a listener's behavior" (Bright, 1984, p. 11), it does not consider any modality other than the acoustic one. It should come as no surprise that the term *information* occurs rarely, if at all, in the discussion of specific cases of animal communication.

Discriminations of the behavior of other organisms are a prerequisite for the evolution of verbal behavior, and analyses of social learning may therefore be of special relevance to the origins of language. *Social Learning* (Zentall & Galef, 1988) was cited in an earlier editorial (Catania, 1989a); its chapters treat a number of cases of observational learning and imitation. The phenomena with which it deals provide the basis, in nonverbal behavior, for the cultural transmission of behavior. The three varieties of selection discussed by Skinner (1981) in "Selection by Consequences" were Darwinian natural selection, the selection of behavior by its consequences within the lifetime of the individual organism, and the selection of behavior within populations as behavior is passed on from one individual to another. It is time to integrate what is known about this third variety of selection with what is known about the others, especially to determine whether its properties

demand an expansion of our behavioral taxonomy.

Cultural transmission manifests itself most significantly in verbal behavior, and here again many sources could be cited. In language as in morphology, ontogeny does not recapitulate phylogeny, but aspects of one can be relevant to the other. The ontogeny of language is usually referred to as language acquisition, and a range of interpretations is available in Fletcher and Garman's *Language Acquisition* (1986) and Krasnegor's *Biobehavioral Foundations of Language Acquisition* (in press).

The units of verbal behavior are of special interest, and these are among the topics considered in *Dialogues on Verbal Behavior* (L. Hayes & Chase, 1991), papers from the first international institute on verbal relations. The title is appropriate, because the volume includes comments of the participants as well as the primary papers. Units of verbal behavior can also be derived from other sources. For example, some of the pathologies described by Sacks (1985) in *The Man Who Mistook His Wife For a Hat* imply different functional classes of verbal responses, as when a piece called "The President's Speech" describes aphasics who responded only to the emotional tone of a speech whereas those with tonal agnosia responded only to its substance. There may also be implications for verbal units in the different types of verbal behavior engaged in by women and men (Tannen, 1990).

In metaphor, the abstract becomes concrete, and analyses of metaphor are therefore relevant to the sources of our technical as well as our everyday vocabularies: Time becomes a spatial dimension (the future is ahead and the past is behind us), and much of the mental vocabulary involves spatial metaphors (we keep things in mind or have something on our mind). *The Body in the Mind* (Johnson, 1987) and *Women, Fire, and Dangerous Things* (Lakoff, 1987) explore some further implications of the processes of metaphorical extension that were considered in the earlier *Metaphors We Live By* (Lakoff & Johnson, 1980; cf. Catania, 1984). It is not difficult to imagine how these treatments can be brought into contact with accounts of the behavioral origins of abstract vocabularies (e.g., Skinner, 1989).

Rule governance has become a topic of increasing significance in the analysis of verbal

behavior, and some detailed discussions of its implications are provided in *Rule-Governed Behavior* (S. Hayes, 1989). Some properties of rule-governed behavior are also evident in treatments outside of behavior analysis. For example, Csikszentmihalyi's *Flow* (1990) deals with those special conditions under which one's verbalizations stop and one's behavior comes into direct contact with contingencies rather than into indirect contact through the mediation of verbal behavior. It supports the assumption that the social contingencies that maintain rule-governed behavior sometimes act to make behavior insensitive to other more immediate contingencies.

The chapters in *Unintended Thought* (Uleman & Bargh, 1989) deal with verbal behavior that may occur, usually covertly, in the absence of the discrimination by the speaker of the contingencies that are its source, and sometimes also in the absence of the discrimination of the verbal behavior itself. It raises the interesting possibility that behavior can be rule governed on the basis of things individuals say to themselves even if they do not know they are saying them. The experimental and theoretical issues are knotty, but the assumption that behavior must come first, before the organism can learn to discriminate between its occurrence and nonoccurrence, is consistent with an analysis of how autoclitic processes operate in verbal behavior (cf. Skinner, 1957).

#### *Potential Reviews*

Here I single out a few more book reviews I would like to have seen in *JEAB*. One of those would allow an exploration of the various usages of the term *representation* in cognitive treatments. It sometimes implies copies, but it often does not. For example, if one is shown written letters and later recalls them, errors are more likely to be based on acoustic than on visual similarities among the letters. The implication is that what is remembered are the responses to the stimuli rather than the stimuli themselves; the responses are recipes for reproducing stimuli rather than copies of them (cf. Catania, 1987; Dawkins, 1986). Spoken letters have no shape and written ones no sound. It is therefore of interest to examine treatments of representations in learning. For example, in *The Organization of Learning*, Gallistel (1990) places special emphasis on spatial orientation in a variety of organisms

and speaks of their orientations in terms of representations called cognitive maps. He deals persuasively with the various performances in terms of navigational categories (e.g., dead reckoning and celestial navigation) and therefore provides the foundations for a taxonomy of the types of behavior involved in spatial orientation by different species.

Other usages of the language of representation can be found in *Varieties of Memory and Consciousness* (Roediger & Craik, 1989), a collection of papers assembled in honor of the contributions of Endel Tulving (e.g., research on cue-dependent learning, clustering in free recall, and the distinction between semantic and autobiographical memory). Inspired by Tulving's work on memory, many of the contributors have moved from mediationist to functionalist treatments of the phenomena of memory and therefore have provided areas of potential convergence between cognitive and behavioral approaches to memory (although some of the contributors may be surprised at such a conclusion: cf. Watkins, 1990).

Categorical perception is concerned with the origins of discriminations among classes of stimuli, and has been the basis for controversies about the dimensions along which complex stimuli are discriminated (e.g., phonetic categories in the perception of speech). It is reviewed in detail in the edited volume, *Categorical Perception* (Harnad, 1987). Given the behavior-analytic interest in stimulus classes arising from studies of natural concepts and equivalences, a review of the history and status of the problem of categorical perception is of increasing relevance.

In *Social Foundations of Thought and Action*, Bandura (1986) deals with complex social phenomena and is critical of many fundamental behavior-analytic concepts. A thorough review and analysis of his treatment may clarify whether he has described phenomena that can be incorporated into behavioral discourse or has developed categories that do not have their foundations in behavior.

Particular subtopics within the analysis of behavior also deserve review coverage (e.g., behavioral economics: Green & Kagel, 1990). For example, I would very much like to see a book review that deals with equivalence classes and their relation on the one hand to conditional discrimination and matching

and on the other to verbal behavior. But first someone has to write the book.

### *Contingencies Within Behavior Analysis*

I found much of interest in Malone's new *Theories of Learning: A Historical Approach* (1990). I have usually refrained from treating textbooks, however, especially because it is so difficult to do so fairly. For example, new editions of texts on behavior and learning by Mazur (1990), Rachlin (1991), and Stadon and Ettinger (1989) have recently appeared, but they are only three among at least a dozen works that might be examined (for me, a further complication is that one of those, soon to appear in a third edition, is my own). Perhaps there will one day be comparative reviews of textbooks relevant to behavior analysis; if so, it will probably be important to represent several points of view, because different texts treat issues of learning and behavior from such very different perspectives.

I have a similar problem in dealing with books within behavior analysis itself, because I have sometimes been involved with them (e.g., as a chapter contributor); the following list would have been shorter had I excluded books in which I had participated in some way. With that caveat, I recommend two books devoted to the contributions of B. F. Skinner (Catania & Harnad, 1988; Modgil & Modgil, 1987), a treatment of the implications of research findings on aversive control (Sidman, 1989), volumes based on theoretical and experimental papers presented at the first and second European conferences on the experimental analysis of behavior (Blackman & Lejeune, 1990; Lowe, Richelle, Blackman, & Bradshaw, 1985), an applied text that demonstrates the increasing sophistication of the applied analysis of behavior and the strength of its ties to experimental analysis (Sulzer-Azaroff & Mayer, 1991), and a new handbook treatment of the field (Iversen & Lattal, in press).

### *More Loose Ends*

The items that follow defy organization, but in one way or another and at various removes they all seem relevant to behavior analysis. For example, Immelmann and Beer's *Dictionary of Ethology* (1989) appeared too

late to be cited in my editorial on dictionaries (Catania, 1989b), but this still does not seem to provide enough closure. Is it appropriate to cite *The Encyclopedia of Learning and Memory* (Squire, in press) even before its publication?

Hull (1989), in *Science as a Process*, offers a philosophy of science that explicitly considers science as behavior, and therefore might have served as the basis for a companion review to Batts and Crawford's (1991) recent review of the philosophy of science of Laudan. As for philosophy in general, for those who occasionally get into debates about the peculiar heritage of Socratic thinking and its continuing legacy of assumptions that stand in the way of a behavioral account, the reinterpretation in *The Trial of Socrates* (Stone, 1988) will come as a useful reminder that Socrates also played a destructive political role in undermining the democratic institutions of classical Athens.

In *More Work for Mother*, Cowan (1983) deals with the contingencies created by household technologies, showing how they reduced rather than expanded the options of women working at home. The treatment provides a detailed view of the sorts of cultural contingencies that have been explored by Marvin Harris (e.g., in *America Now*, 1981).

In *A Whisper of Espionage*, Ley (1990) tells the curious story of Köhler's activities on the island of Tenerife: His apes were not native to the island, and Tenerife provided a useful base for the observation of allied shipping during World War I. Ley makes a compelling case that Köhler's anthropoid station was a cover for German espionage activities.

Allied shipping during the next world war played a major role in the career of Alan Turing, of the Universal Turing Machine, the Turing Test, and the foundations of modern computer science. In *Alan Turing: The Enigma*, Hodges (1983) tells of Turing's significant role in breaking the German Enigma code. During World War II, the code was used in military messages, such as those to submarines assigned to intercept allied shipping between the United States and Europe. This is the Turing whose work in number theory provided some precursors of Chomsky's later mathematical treatments of linguistic structure, which in turn gave Chomsky the prestige that made so influential his other,

nonmathematical judgments (including his now notorious review of Skinner's *Verbal Behavior* [1957]).

There has not been much here about behavior analysis and the physical sciences, but what can we say about physicists who are unfamiliar with behavior and yet speculate about consciousness, mind, and free will on the basis of concepts derived from chaos and quantum mechanics? The current candidate is Penrose's *The Emperor's New Mind* (1989), which is nevertheless rich in insights on mathematics, computers, and Turing machines. Consider how close to a behavioral account is the following:

It has been helpful in the above description to use the anthropomorphic term "know" in reference to an algorithm. However, is it not *we* who are doing the "knowing," while the algorithm just follows the rules we have told it to follow? Or are we ourselves merely following rules that we have been programmed to follow from the construction of our brains and from our environment? The issue is not really simply one of algorithms, but also a question of how one judges what is true and what is not true. (Penrose, 1989, p. 65)

Another passage on mathematical truth suggests the distinction between contingency-shaped and rule-governed methods of proof:

... the mental procedures whereby mathematicians arrive at their judgement of truth are not simply rooted in the procedures of some specific formal system. We *see* the validity of the Gödel proposition ... though we cannot derive it from the axioms. The type of "seeing" that is involved ... requires a mathematical insight that is not the result of the purely algorithmic operations that could be coded into some mathematical formal system. (Penrose, 1989, p. 110)

The distinction between computable and deterministic systems is of special interest. Penrose is also clear that a free will based on quantum processes might be no better than one based on the flip of a coin, and is therefore hardly preferable to a determined choice based on the contingencies acting on alternative outcomes.

If you were impressed by Tufte's *Visual Display of Quantitative Information* (1983; see also Iversen, 1988), then you will also want to examine his *Envisioning Information* (1990),

a beautifully designed book that further expands on the contingencies of data presentation. On the topic of visual presentation, consider also Shepard's *Mind Sights* (1990), which presents calligraphic inventions, illusions, and other visual explorations, in the spirit of Escher prints and Kim's *Inversions* (1981).

### *Closing Contingencies*

And of course something had to be saved for last. I have chosen Lipton's *Exaltation of Larks*. First published in 1968, it has now appeared in an expanded edition (Lipton, 1991). Lipton describes the sources of familiar collective nouns (as in a pride of lions, a litter of pups, and a gaggle of geese) and those that once were proper but have since become obsolete (a murmuration of starlings, an unkindness of ravens, and, as in the title, an exaltation of larks). He also invites us to add contemporary terms (a rash of dermatologists, a hive of allergists, a smear of gynecologists, a brace of orthodontists, a stream of urologists, and a pile of proctologists), so how can we resist the invitation? Consider a maze of Tolmanians, a complex of psychoanalysts, a contiguity of Guthrians, a string of linguists, a ring of Pavlovians, an altruism of sociobiologists, a gradient of Hullians, an inference of statisticians, and a representation of cognitive psychologists. I have not yet seen a satisfactory term for a collection of psychologists (a sigh of psychologists, like a herd of audiologists, is better heard than seen), but there does seem to be one inevitable term for the readers of this journal: Find us together anywhere and we are a contingent of behavior analysts.

We started with contingency, and it is as good a concept as any with which to finish. Enough of the loose ends. I congratulate Marc Branch for his good judgment in appointing Philip N. Hineline as the next Review Editor. I was fortunate in having served as a place in which certain processes could occur, and my time as Review Editor has been one of the most rewarding experiences of my entire career. I therefore also congratulate Philip N. Hineline for the opportunity that this appointment presents to him; I wish him the same good fortune I have had. Now my labor is over: I have come into possession of my editorial. May your reading be consequential.

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